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ABSTRACT

This study uses discursive perspectives to study emotion in school mathematics. The researchers regard emotion as distinct but inseparable from cognition: the organizing metaphor portrays emotion as a charge attached to ideas or (chains of) signifiers. Based in language, emotions are seen as discursively formed, culturally constituted, and socially organized. To illustrate, a verbal text based on a video record of small group mathematical problem solving is analyzed. The structural phase analyses of the positions available to subjects in this particular field is analyzed. The textual phase first describes the positions actually taken up by specific subjects through examining the use of language in interaction; the second stage attends to indicators of emotion used by several strands of the theoretical framework, including the psychoanalytic. Results indicate a range of emotions such as inclusion, excitement, and anxiety. (Contains 24 references.) (Author/KHR)

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Emotion in School Mathematics Practices: A Contribution from Discursive Perspectives

by
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Emotion in school mathematics practices: A contribution from discursive perspectives

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Our work uses discursive perspectives to study emotion in school mathematics. We see emotion as distinct, but inseparable, from cognition; the organising metaphor portrays emotion as a charge attached to ideas or (chains of) signifiers. Based in language, emotions are seen as discursively formed, culturally constituted, socially organised. To illustrate, we analyse a verbal text, based on a video record of small group mathematical problem solving. The structural phase analyses the positions available to subjects in this particular field; here we isolate five available pairs of positions, which can be related using the idea of pedagogic discourse. The textual phase first describes the positionings actually taken up by specific subjects, through examining the use of language in interaction; the second stage attends to indicators of emotion, used by several strands of our theoretical framework, including the psychoanalytic. Here we find indications of a range of emotions such as inclusion, excitement and anxiety.

Introduction

As part of a wider theoretical project, we have been working with others to develop ways of conceptualising emotion in school mathematics practices that (a) avoid an affective/cognitive dualism and (b) see emotion as a socially organised phenomenon[1]. The project has drawn on a number of theories that might be considered as broadly 'sociocultural'. In this paper, we refer to several of these theories, but focus primarily on discursive perspectives. We discuss how our theoretical framework might be used to analyse the occurrence of emotion in teaching / learning situations and to consider its implications. We present an analysis of a short classroom episode.

Both mathematics education research and the discourses of mathematics teaching and learning in the classroom have been characterised by a relatively long-term neglect of emotional issues. This neglect was especially pronounced in the 1950s and 1960s, when individualistic perspectives on teaching and learning and behaviourist approaches in the field of psychology, the basis of most mathematics education research at that time, were dominant. The ascendancy of cognitive approaches in psychology did little to challenge the neglect of the affective. However, concern about gender differences in school mathematics performance, fuelled by the new feminist movements of the 1970s, led to explanation of performance discrepancies by gender differences in

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[1] The project *Teaching and Learning – Mathematical Thinking* has been supported by the Fundação para Ciência e Tecnologia grant no. PRAXIS/P/CED/130135/98. Our co-workers in this project, João Filipe Matos, Susana Carreira, Steve Lerman and Madalena Santos, have made enormous contributions to the development of our thinking about this topic (and others).

P. Valero & O. Skovsmose (2002) (Eds.). Proceedings of the 3rd International MES Conference. Copenhagen: Centre for Research in Learning Mathematics, pp. 1-14.

affective responses to school mathematics (rather than by, say, general or specific cognitive ability differences). These affective differences were variously formulated in terms of attitudes, beliefs, or 'mathematics anxiety', and their relationship with performance portrayed by several different models (Evans, 2000). In general, McLeod observes that attention to the role of emotion in maths education research tends to ebb and flow (1992, p.575). We can note a similarly variable emphasis on affect and emotion in policy-making.

In the 1980s and 1990s, there was a move to take more account of 'the context' in mathematical problem-solving, and a 'turn to the social' in mathematics education research and in some areas of school mathematics practices. There was a subsequent move to the deployment of sociocultural theories of various types – in research, at least. Sociocultural approaches can be understood to include situated cognition and a range of other approaches used by researchers who have worked under the banner of activity theory or Vygotskyan approaches.

At around this time, there was also a 'turn to language', leading to efforts to use discursive approaches, including structural approaches (e.g. Bernstein, 2000) and poststructural approaches (e.g. Walkerdine, 1988). However, there has not been much attention given to emotion among specifically sociocultural approaches in mathematics education research to date, with few exceptions: Walkerdine (1988), Evans (2000), Cobb et al. (1989). Other researchers have addressed emotion from a 'cognitive-constructivist' (e.g., McLeod, 1992; deBellis and Goldin, 1996) or a psychoanalytical perspective (e.g., Nimier, 1993). Our aim here is to take account of these approaches, but to go further to locate emotion as socially organised. We note a renewed interest in affect and emotion in psychology, and signs of a developing interest in mainstream sociology (e.g., Kemper, 1990). For all these reasons, we believe that an approach to research and practice in mathematics education that takes proper account of the affective and the emotional, and sees these as socially organised, is much needed and long overdue. We aim to consider what an approach informed by an attention to the social, and to language and discourse, can offer for the study of emotion.

A discursive approach to emotion

We start from a notion of *discourse* as the semiotic moment of a practice. A system of signs (or chains of signification), categories and concepts provides resources for participants in practices to construct meanings for their experiences, accounting for their actions, and their identities. At the same time, it regulates specific social and institutional practices. That is, it enables and constrains what it is possible to say, to do, to be – and to feel: discursive practices are understood as "places where what is said and what is done, rules imposed and reasons given, the planned and the taken for granted meet and interconnect" (Foucault, 1991). Bernstein discusses the construction of pedagogic discourse, by a "recontextualising principle which selectively appropriates, relocates, refocuses and relates other discourses to constitute its own order" (Bernstein, 1996, pp.46-47). Thus the conceptualisation of the

regulation of individual actions and experiences in terms of a pedagogic discourse which embeds an instructional discourse in a regulative discourse is based on the integration of macrolevels of analysis with institutional and interactional levels and allows the translation of "distribution of power and principles of control into forms of pedagogic communication and their contextual management" (Bernstein, 1996, p.3).

The above definitions systematise the aspects of discourse identified in the structuralist literature, while preserving the insights of social semiotic and post-structuralist approaches. Thus crucial aspects of discourses include:

- They express the *goals* of a practice, and are infused with *values*, norms, standards of evaluation.
- They have an *ideational structure*, specifying what objects are significant and meaningful, what actions are possible, what *positions* are available.
- They also have a *social interactional* aspect, with a basis in social relations of *power*; this regulates how positionings come about and how evaluations take place.
- They can be seen as *systems of signs* – semiotic relations between signifiers and signifieds.

Adopting a discursive approach to studying emotion entails maintaining a focus not on the isolated experience of the individual but on the ways in which discourses make the experience of the individual both possible (and perhaps probable) and meaningful. Most approaches to discourse analysis have not previously addressed the issue of emotion in a systematic way. We need, therefore, to develop a way of conceptualising emotion.

1. First, we find it useful to speak of emotion as a 'charge' attached to (or infusing) ideas or (chains of) signifiers. The notion of 'charge' is taken from a psychoanalytic tradition, for example, Freud [1916-17] (1974, pp. 443-48) sees anxiety as involving 'motor innervations' or 'discharges'. This metaphor is appropriate in that it captures something of the energy and *intensity* of emotion, and allows for a unified approach to cognition and affect, to thinking and emotion.

2. The Freudian use of 'charge' may appear to imply an essentially individual experience. By seeing this as inextricably connected to signification, however, it is located within discursive practices, and hence *socially organised*.. The charge does not come from essential characteristics of an individual, but from interaction between the person's past experience, that is their personal history of involvement in discursive practices, and their present discursive positioning(s). This history is itself structured, and differentially, in ways related to (at least) the social class of the child's family (e.g. the 'orientation to meaning',), and the form of pedagogic practices (e.g. visible vs. invisible), and discursive practices generally (Bernstein, 2000).

3. Emotion is also *culturally and historically constituted*: language/discourse is implicated in expressing emotion, and in constructing accounts for people's actions (Edwards, 1997). Indeed, past experience is *not completely structured*, because language has the capacity to form unexpected linkages between practices via interdiscursivity and intertextuality. Therefore,

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emotion can be seen in this approach as *fluid*, since its connection with specific signifiers, ideas, cognitions is not fixed. Interdiscursivity and intertextuality, in turn, are enabled, both by the cultural linking of practices (for example, through interaction rituals or through advertisements), and by the contingencies of the individual's history of experience. Teachers' attempts to link school to home practices and discourses in order to aid understanding are often, but not always, successful. Sometimes they may fail because what appears to be 'the same' signifier has different relations of signification in the two discursive practices. See Walkerdine's (1988) discussion of 'more' in school and home discourses (contrasted with 'less' and 'no more' respectively).

4. The nature of the *charge* or the energy of emotion may be understood to come from different sources. Some accounts may be based on the importance of socially-valued goals (e.g. activity theory), others to various forms of 'motivation'. One approach to the latter is through using a *psychoanalytic* perspective emphasising *desire* (Henriques *et al.*, 1984). The main concepts are:

- desire: but also the possibility of pain, loss, distress, contradiction; leading to the operation of various *defence* mechanisms, effecting *repression*;
- *the unconscious*, 'structured like a language';
- the psychic processes of *displacement* and *condensation* (represented in discourse as metonymy and metaphor, respectively). Displacement, in particular, provides the basis for (much) fluidity of language and emotion.

We thus avoid considering emotion as an essentially individual experience, but emphasise the ways in which it is socially organised. A discursive approach allows us to explore how meaning can flow along a signifying chain, and drawing on psychoanalytic insights helps us to understand how flows of emotional charge might be another aspect of the 'dynamics of language'.

Analysis of emotion in classroom practices – methodological tools

We wish to be able to explore the role of emotion in empirical examples of mathematics classrooms. The discursive perspective leads us to see our empirical data as a text, our reading of which is produced by a combination of *structural* and *textual* analyses. The former helps to identify the fields, agencies and agents within and by which discourses are constructed, as well as the forms of practice and positions that are thus available. The textual focuses on what other analyses call interactional aspects, but also stresses the role of language and its dynamics in shaping the situation of interaction. Our reading is produced using resources drawn both from theoretical discourses and from experience of participation in other discourses, including those of (other) mathematics classrooms (using what Fairclough (1989) calls "members' resources"). The empirical data in our example include a transcript of a classroom episode with a description, written by the original researcher, of the context of the episode, including information about the national education system and about the particular classroom.

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Structural analysis

Structural analysis addresses the nature of the pedagogic discourse and other discourses within which the participants are situated. In particular, analysis of the *positions* available within the discourse is a prerequisite for understanding the identities, actions and ways of meaning (and feeling) that may be available for individuals positioned in particular ways. Given positions are associated with various degrees of *power* in relation to the practice and to other participants and are accorded various *values* within the discourse. As individual participants are positioned in discourse, the play of values and of power creates opportunities or spaces within which emotion is valid or indeed likely to arise. In many cases, there is more than one possible position for an individual, either because of flexible possibilities within a single discourse or because there are several competing discourses available. Here, the potential for *conflict* between positions may give rise to emotion. For example, textual analysis of a teacher engaged in assessing student's written work (Morgan, 1996) identified her experiencing a 'problem' – as much affective as cognitive – as she shifted between a position as an examiner within the official assessment discourse and a conflicting position as advocate on behalf of the student within an alternative child-centred discourse. Cooper & Dunne (2000) also illustrate possible contradictory demands made on the individual by different discursive practices.

Discourse presupposes a systematically organised structure of positions and practices (see above). Pedagogic discourse creates transmitter and acquirer positions and visible or invisible forms of pedagogic practice that regulate the social-pedagogical relationships for the transmission, acquisition and evaluation of a privileged content. Here we can only indicate how one can proceed to identify this structure (for a more analytic treatment and an application to empirical data see Morgan, Tsatsaroni & Lerman, forthcoming).

Initially, the basic characteristics of pedagogic practice may be described, but note that this is already theoretically informed. These empirical characteristics can then be represented in terms of formal definitions of practice, varying in terms of the strength of classification (vis-à-vis other practices), and framing, i.e. the regulative aspects of discourse (rules of hierarchy) and the instructional aspects (sequencing rules and criteria of evaluation). The empirical description is thus transformed theoretically into values of classification and framing, thereby making visible other possible combinations, providing rules for identifying empirical events or experiences in that aspect of the world with which the theory is concerned, including possibilities not yet experienced as actual events (Moore, 2001). To link this methodical analysis explicitly to issues of cognition and emotion that interest us here, by paying attention to values of classification and framing we can identify not only which cognitive contents, but also what norms of social conduct and what socio-affective competencies (such as sharing, respect, expressing joy) are privileged by the pedagogic practice (Morais & Rocha, 1999).

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Textual analysis

The structural analysis provides us with an overall view of the positions available, the spaces within which emotion may arise and the roles that expression of emotion may play within a discourse. By turning to the textual we can attempt to identify how positions are occupied, how opportunities arise for emotion as a form of meaning and how expression of emotion occurs and functions. In the example below, the text is a transcript of a video of a group of pupils working on a mathematical problem within a classroom. The text includes both the words of the pupils and a partial verbal interpretation of the visual content of the video. In general, texts may take other forms, including non-verbal. Here, however, it is convenient to focus on a verbal text.

The textual analysis is conducted in two stages. The first stage focuses on the properties of the text itself, identifying in particular those *interpersonal aspects* of the text that function to establish (or attempt to establish) each participant in particular discursive positions. For a verbal text, the analytic tools include those of functional grammar (Halliday, 1985) as used in Critical Linguistics (e.g., Hodge & Kress, 1993) and Critical Discourse Analysis (e.g., Fairclough, 1989). The indicators to which we attend include:

- reference to self and others through, for example, the use of personal pronouns;
- reference to valued aspects of the discourse, e.g. claiming to understand or to be correct;
- the modality of utterances, indicating degrees of certainty and uncertainty in relation to the subject matter;
- other 'linguistic danger signals' (Jensen, 1989) such as hidden agency (e.g., using passive rather than active voice) or repetition of the same or related semantic terms.

The language used functions interpersonally to *realise* the positions (identified structurally) in the *dynamics* of the situation. The analysis focuses on the (implicit) ideological messages projected and the relationships established between speakers and their interlocutors and between speakers and their subject matter. This stage of the analysis does not seek to make claims about the presence or nature of emotions for the participants. It merely seeks to identify the ways in which they are positioned or seek to position themselves and the ways in which they and their contributions are valued within the discourse. It thus identifies the critical incidents, the spaces within which emotion may arise, but has little to say about their nature.

We therefore need a *second stage of textual analysis*. This stage attends to those overt indicators of emotional experience understood/used within the broad cultural discourses in the relevant society or subculture. It also attends to the 'play of signifiers' in the critical incidents, trying to reconstruct chains of signifiers in the text, sensitive to the possibilities of relations between chains and discourses being either reinforcing or conflictual. In addition, the analysis is alert to possible psychoanalytic infusion of the language used.

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A range of indicators may provide evidence of the experiencing of emotions. (Some of these, e.g. use of particular metaphors, may be relevant from various theoretical perspectives.)

- overt indicators of the experiencing of an emotional charge, via bodily or behavioural indications, or the verbal expression of feeling;
- verbal or gestural emphasis, or textual repetition, to indicate strong (or chronic) feelings;
- non-verbal indicators, including vocal intonation, and bodily or behavioural 'body language'.

For the play of signifiers:

- 'key signifiers' that may have meaning within more than one discourse and may be indicating emotion from the play of meanings at the intersection of discourses, see, for example, Evans' (2000) discussion of Ellen's use of 'expense', and Fiona's 'calculating';
- the use of particular metaphors (Kovecses, 2000)

From a psychoanalytic point of view, seeking possible evidence of the operation of *defences* against strong emotion, such as anxiety, or other intrapsychic conflicts (Hunt, 1989), we look for indicators for *exhibiting* emotion (rather than for *expressing* emotion):

- 'Freudian *slips*' (*parapraxes*) or *jokes* made by the subject: e.g. a 'surprising' error or memory failure in solving a problem, given the student's previous performance or experience;
- *denial* (say, of anxiety): e.g. 'protesting too much', making an assertive 'statement' that the subject feels exceedingly confident about mathematics;
- *behaving 'strangely'* or unusually: e.g. laughing a lot, especially 'nervously', talking unusually quietly, or unusually loudly; or *impatience* to know the 'right answers' for a problem.

In addition, psychoanalysis alerts us to a number of themes that recur in emotional experience. These include:

- *transference* by subjects of feelings (from earlier relationships) onto a teacher – or the researcher; *anxiety*, a theme that has been emphasised in many recent studies of mathematical affect;
- *identification,* processes whereby pupils might seek to take on characteristics/ aspects of the Other;
- *resistance* to authority figures, or to peers who would be authoritative.

Indicators for these can be specified. (Hunt. 1989; Evans, 2000, Ch.8).

Example

The extract of classroom data that we analyse here involves three boys, Filipe, Mário and Tiago, working together on a mathematical task.[2]

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[2] The larger data set from which this is taken was originally collected by Madalena Santos for research with a different focus, and therefore not giving the same emphasis as here to emotional aspects of learning. We are grateful to her for permission to use the data, for her translation of the transcript into English and for her background information about the

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Structural analysis

Our structural analysis is based on a text written by the original researcher, providing a brief description of the Portuguese education system and of the normal practice in the particular school and classroom. From this, we identify significant concepts, values and technologies and use these to identify positions that may be available to students participating in this classroom.

In Portugal, students may be judged to fail a year and must then repeat it. This creates positions, defined by explicit criteria, of *failing student* and successful or *'normal' student*. We assume that progressing with one's age group is considered 'normal' (hence suggesting a neutral valuation) while failing positions students in a way that is marked negatively. A finer graduation of positions within the 'normal' student position is suggested by the researcher's comment on the students involved in the episode discussed here that "From their marks this year in mathematics we can consider them as *medium students* – Tiago and Filipe are a little better than Mário but none of them is the best (or worst) student within this class." The technology of marks creates a structure for comparing and ranking students and attaches official positive value to higher rankings. The value system is not necessarily adopted by all students. Indeed, the students in this case appear to use rather different criteria; they are said to evaluate each other as "good" and "rather weak" students. But they still make use of the systemically constructed idea that value can be attached to individuals according to their performance on academic criteria. The differences between teacher evaluations and student evaluations of each other suggests that positioning of individual students may vary between situations of interaction with teachers and with fellow students. Such differences in positioning may give rise to conflict for individuals in some situations and hence provide a space for emotion to arise.

The evaluation dimension is dominant in the official discourse but we see that in the classroom this is recontextualised. Further description of practice in this classroom suggests a 'progressive' form of pedagogy in which students are encouraged to work together and concepts such as 'help' and co-operation are valued. This pedagogy creates other possible positions:

- *helper* and *seeker of help*. Moving around the classroom to seek help is a legitimate activity, though it is not clear to what extent it is actually encouraged and valued. It seems likely that the *helper* would be positioned more powerfully.
- *collaborator* and *solitary worker*. In group work, collaboration is explicitly valued by the teacher but this does not always happen. As the classroom tasks are not always organised as group work, it is possible that some conflict arises for individual students between different positions available to them. The classroom discourse is not unitary but may be seen as (at least) two competing discourses, one of which values collaboration while the other

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Portuguese education system and about the history of the class. The lesson from which our extract is taken is discussed in Santos & Matos (1998).

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values individual performance (the assessment system allocates marks to individuals).

- *director of activity*. We are told that the teacher is normally the one who initiates and directs activities. When the classroom is organised for group work, however, it is possible for students to bid for such a position within their group. Again, there is an inherent asymmetry, so we can assume an associated, less powerful, position as *follower of directions*.
- *evaluator*. Unlike in more traditional forms of pedagogy, we are told that the students "spontaneously and frequently checked their solutions between them, not depending on the teacher evaluation". Evaluating is an essentially powerful action, especially when exercised on other people. Do all students participate in evaluation in similarly powerful ways or are only some of them able to occupy an evaluator position? Who is subject to evaluation and by whom?
- *insider* and *outsider*. This pair of positions is deduced from the information that Tiago and Filipe consider Mário to be "a little bit 'rejected' by most of the colleagues". It is not clear to what extent these positions are associated with the criteria of the official classroom discourse or with discourses in which the students participate outside the classroom.

The positions identified above stem from an engagement with the empirical world informed by the discursive approach. The analysis thus far makes a significant step in the move referred to earlier from the descriptive account, given by the original researcher, of the empirical world towards the theoretical axis of the research process. Using the concepts of classification, framing, and regulative and instructional discourse provided by Bernstein's theory, we can now proceed to characterise the form of practice, and to derive systematically the positions available to students within it.

The local school activity is structured as an invisible form of pedagogical practice: both classification and framing values of its instructional discourse are weak. Thus the position of *evaluator*, dominant in the official discourse, is downplayed or weakened, making the hierarchical nature of the relationship between transmitter and acquirer implicit (C-). Control over the sequencing rules and criteria of evaluation of the activity also remains implicit, thereby making the *director* and the *follower of direction* appear as equally valid positions (F-). However, the regulative discourse of the practice is more explicit, stressing the values of co-operation and sharing. This creates a division between *helper* and non-helper, and between *collaborator* and *solitary worker* (C+) while the position of the helper and the *seeker of help* appear to be equally valued and legitimate Similarly, social relations between pupils are framed by the emphasis on *collaboration*, which is explicitly valued (F+) within this form of pedagogic practice. The systematically derived student positions in the discourse are depicted in the figure below.

Instructional Discourse	Evaluator (C-)	Director (F-)
Regulative Discourse	Helper (C+)	Collaborator (F+)

The discrepancies between the implicit hierarchies of the instructional discourse and the explicit privileging of certain forms of conduct of the regulative discourse create contradictory subject positions. These become visible when we apply theory. The structurally created ambivalence in the pedagogic discourse as realised in this particular mathematics classroom should figure centrally in the explanation concerning the pair of student positions, *insider/outsider*, identified in our initial application of a discursive approach.

Textual analysis

The text is a transcript of a video recording of two minutes of work by the three boys on a task introduced by the teacher. Our analysis is interpolated in boxes: the left-hand side focuses on positioning, the right-hand side on indications of emotion.

They are all going on with their work. Filipe is the first to finish, puts down his pencil and starts talking again passing to the next question.

(41) Filipe This is very simple. To what distance should the taps throw the water to irrigate all the field?

Filipe reads aloud the question number three while the others are finishing their work, Tiago is the first to follow the reading in his sheet, then Mário finishes and he too follows, but by Filipe's sheet. Tiago seems to test something in his drawing with the ruler and stops reading.

(42) Filipe Hum...

(43) Mário Now what?

(44) Filipe Hang on a second, the tap of irrigation throws the water up to 11 meters, one is by the post the other by the stack.

F's statement (41) that it is "very simple" can be seen as a claim to authority through knowledge and hence 'good student' status. By stating and restating the question and by using the imperative "Hang on a second" (44) he positions himself as the director of activity in the group. M, by asking for direction (43), is positioned in a subordinate way.	This might *also* (not necessarily alternatively) be seen as 'protesting too much' – reversal into the opposite, a defence (against anxiety).

(45) Tiago 13 meters it's enough.

This is not a correction of the reading but on the other hand an answer to question 3 which seems, was taken from the measuring he did in the drawing. It seems he had a quick perception of the problem.

(46) Filipe No... OK... what distance should the taps be... they should throw the... the taps should throw the water to irrigate all the field?

Filipe reads with some hesitation the text of the question with some attempts from Mário and Tiago to clarify his reading or to speak. Tiago follows the reading again and seems to change opinion about his previous answer.

(47) Tiago Ah!... in the middle is enough, I think.

Tiago seems to have now understood the question in a different way than before (which seemed right to me but which was very intuitive and not explored). By

following Filipe reading Tiago, seems to have understood the question in another way.

T's initial statement (45) with it's positive modality can be seen as a claim to authority through knowledge, which is challenged by F's evaluation (46) and further attempt to direct activity. T's adjusted claim (47) has a lower modality, modified by "I think", possibly suggesting that he is deferring to F's challenge. Alternatively, his use of the first person may indicate withdrawal from the group situation, positioning himself as a solitary worker.	Although a review of the video suggests F's "no" (46) may be in response to M, rather than to T! Yet F's body does seem to stiffen at this point, suggesting resistance or fear/anxiety. A possible indicator of isolation for T?

(48) Filipe Let's see

They go back to their notebooks. Mário with the compass, Tiago with the ruler and Filipe looking while he waits for the compass that Mário gives him later

(49) Filipe So we now do it like this, with the compass, enlarge it...

Filipe puts the point of the compass in one of the dots and opens it trying either one side or the other until he gets what he searched for.

(50) Mário And there?

(51) Filipe We do likes this... Easy, I have done it minding that piece over there...

(52) Mário Ah... *[Mário agrees (or confirms that he understood) with Filipe]*

In this section, F's use of imperatives and normative statements of what "we" do again indicate his position as director of activity, while M adopts the complementary position.	At the same time, M's "'agreement or confirmation of understanding' (note) suggests (a bid for) inclusion.

(53) Tiago But it doesn't get there [Tiago keeps doing it and speaks about what is happening in his drawing looking again to Filipe's] So, where does it have to throw? Ah... they are two!... Now I know... [he goes back to his drawing]

While T appears to challenge F's direction with his initial statement, he does not follow this up but again withdraws himself from collaboration, focusing on his own knowledge "Now I know".	A possible indicator of isolation again for T. Alternatively, this may be an indication of motivation to obtain satisfaction from a fuller understanding.

[Fr is drawing. Mário observes very attentive, inclined over the table, like Filipe and Tiago do]

(54) Filipe Quite right! [Certinho! – subsequent discussion of the translation has suggested that 'Bang on!' might be an appropriate colloquial English equivalent]

(55) Mário That's it! [É mesmo!] [Mário goes with his eyes from his drawing to the eyes of Filipe for a moment and again returns to his drawing]

(56) Mário Quite right! Fantastic! [Mário turns his eyes again to the eyes of Filipe, he begins smiling, with his right arm touches Filipe in his shoulder for a second]

(57) Mário You know! [said almost in private to Filipe]

(58) Filipe No, it's a question of doing here to irrigate there for sure, then you try there and, if needed you enlarge it a little *[going with his eyes from his drawing to Mário's eyes]*.

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[Mário is listening to the explanation of Filipe, his eyes in contact to Filipe's eyes, savouring, delight, submitted?; he 'says' yes with his eyes, agrees with his head; he opens and closes his legs in a movement denoting satisfaction; at this moment Tiago goes from his drawing and looks at Filipe's drawing]

Both F and M are making positive evaluations of F's solution. However, both form and function of these evaluations differ, giving rise to different positionings. F both initiates the evaluation and at (58) provides explicit criteria for the evaluation, thus establishing himself both as evaluator and as being in control of the knowledge. M, on the other hand, does not indicate any criteria and attributes the knowledge explicitly to F (57). His statements serve to reinforce F's powerful position rather than to claim his own right to evaluate. At the same time, M's body language also suggests a subordinate position.	Here we also have some evidence of emotion, evidenced by the intonation coded by exclamation marks on (54) 'Quite right!' or 'Bang on!' and (55) 'That's it!', and the positive terms used (perhaps with links to youth and sports culture), indicating satisfaction. Further, we have the body language of M - touching F's shoulder, making eye contact, gleeful wiggling of legs - which denote excitement; this excitement may be generated merely by the successful solution of the problem. However, might this *also* be delight at being *included*?

(59) Tiago So how did you do it?
(60) Filipe I measured from there to there to irrigate for sure this piece over here...
(61) Tiago Yes...
(62) Filipe -Then I looked here and here and it fitted rightly.

This explanation from Filipe is done for Tiago and was accompanied of the indication of the places "here and here" which seem to be the radii of the two circles with the centre in P and E. Tiago observes but doesn't seem to be convinced. Mário continues with his own drawing and Filipe returns quickly to his drawing to remake it more precisely. Tiago returns to his own work and traces, with the compass, one of the bowls of the circle Filipe refereed and asks:

(63) Tiago So where did you put it?
[There is no answer to Tiago question.]

T's questions may be requests for help or challenges to the status conferred on F in the episode of evaluation.	Or they may be indicators of anxiety - at being left behind, or left out? Or T's not seeming to be convinced may be an example of *resistance* - to F, who is attempting to take up the position of director/evaluator

Reflections

The idea of the inseparability of the cognitive and affective is supported theoretically in the idea of *positioning in discourse*. However, we do not propose that affect can be assimilated to the cognitive. Rather, the idea of affect and emotion as charges attached to the ideas, the signifiers, the cognitive conveys the notion that emotion is *in principle distinct* from the cognitive, but at the same time *attached* to it, though not in a fixed or permanent way.

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Further, if we imagine a pedagogy structured around emotions about mathematics as well as cognitive knowledge of the subject, which children do we think would be competent in these interpersonal forms of communication? There are issues of social control here as well as 'purely' cognitive ones, for example, on which aspects would children from different backgrounds concentrate in such a pedagogy. If we imagine further such a pedagogy being institutionalised as official policy, in which levels of schooling, types of school or types of classes would such a pedagogy become dominant – early primary, remedial classes, evening schools/technical-vocational classes for young workers, or high schools for the children of the privileged?

Methodologically, we can make several points about the uses of different types of data for the study of emotion. First of all, mathematics classroom data will usually be focussed on ostensibly 'cognitive', tasks. This means that the indicators usually used for emotion by researchers – which arguably overlap very much with those indicators attended to in everyday life by lay actors – are not very much in evidence. A further useful source of data would be follow-up, de-briefing interviews where participants are presented with video clips (etc.) of the prior action and asked to recall and say what they meant/felt. This holds whether or not one is drawing on psychoanalytic insights, but is probably more pronounced if one is. The incompleteness in this analysis (so far) is the difficulty of reading links with the person's *history of positioning*. This is almost impossible when the researcher cannot probe in interviews to produce 'personal history' interpretations (let alone psychoanalytic ones).

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